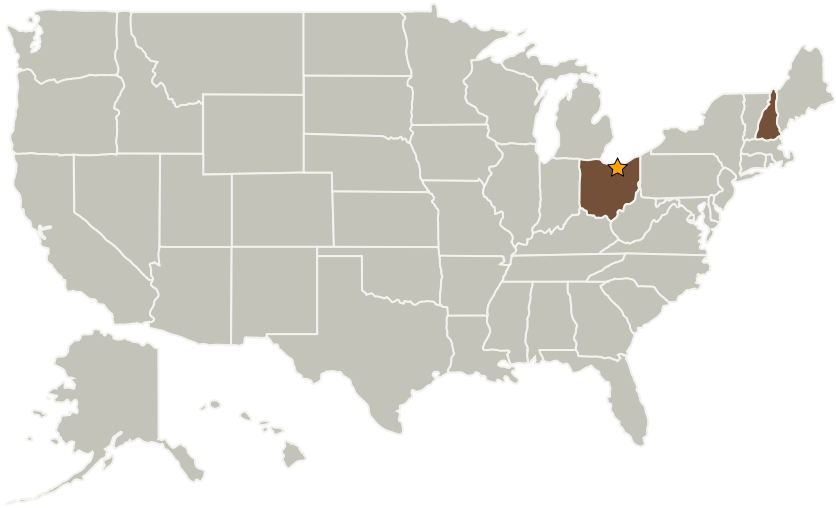
Thermal Management System for Superconducting Aircraft, Phase I

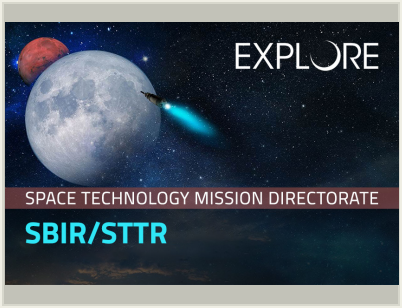
Completed Technology Project (2009 - 2009)

Project Introduction

Aircraft powered by hydrogen power plants or gas turbines driving electric generators connected to distributed electric motors for propulsion have the potential to transform the aircraft design space by decoupling power generation from propulsion. Resulting aircraft designs such as blended wing bodies with distributed propulsion can provide the large reductions in emissions, fuel burn and noise required to make air transportation growth projections sustainable. The power density requirements for these electric machines can only be achieved with superconducting materials. However, their feasibility is dependent on improving the power density of the cryocoolers needed to cool the superconductors to their operating temperatures. We propose a Cryoflight turbo-Brayton cryocooler, optimized for low weight and high efficiency. Our initial design studies indicate that this design will exceed the mass and performance targets identified by NASA for superconducting aircraft. In Phase I of this project we will extend our initial design study to include a system trade study and individual component designs (TRL 3). In Phase II we will demonstrate the turbomachine, the most critical component in the system (TRL 4). In Phase III we will demonstrate a complete cryocooler (TRL 4 and TRL 5). Our proposed Cryoflight cryocooler development effort will provide an enabling technology for superconducting aircraft, which have the potential to revolutionalize future air transportation.

Primary U.S. Work Locations and Key Partners





Thermal Management System for Superconducting Aircraft, Phase I

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

Thermal Management System for Superconducting Aircraft, Phase I

Completed Technology Project (2009 - 2009)

Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Creare LLC	Supporting Organization	Industry	Hanover, New Hampshire

Primary U.S. Work Locations	
New Hampshire	Ohio

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.3 Thermal Conditioning for Sensors, Instruments, and High Efficiency Electric Motors